Shock Propagation and Banking Structure

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Motivation

- Interconnected firms and industries lead to propagation and amplification of shocks throughout the economy (Acemoglu, Carvalho, Ozdaglar, and Tahbaz-Salehi 2012)
- Negative shocks can lead to fire sales and deplete firms' balance sheets in an industry (Lang and Stulz 1992)
- Shocks may also ripple through the supply chain (Hertzel, Li, Officer, and Rodgers 2008; Barrot and Sauvagnat 2016)

This paper

- Is banking structure related to the extent to which cascade effects due to interconnections propagate?

- **Main idea:**
  Lenders should be prone to internalize externalities of industry distress if they have large shares of the loans outstanding in that industry

Data description

- U.S. syndicated loans from DealScan
  - Data aggregated at the bank-industry-time level, *ijt*
  - Loan amount y_{ijt} (t: six months) and *Market share*$_{ijt-2}$ (measured over the previous six years)
- Historical industry stock returns from CRSP
  - *Industry distress*$_{it-1}$ indicates whether industry i experienced a cumulative median stock return of less than -10% in the previous half-year $t-1$

Empirical strategy

- Analyze lending by bank j to industry i following distress as a function of bank j's past market share in i:

$$\begin{aligned} y_{ijt} &= \beta_1 \textit{Market share}_{ijt-2} \times \textit{Industry distress}_{it-1} \\ &\quad + \beta_2 \textit{Market share}_{ijt-2} + \mu_{ij} + \theta_{it} + \psi_{jt} + \epsilon_{ijt} \end{aligned}$$

- θ_{it} and ψ_{jt} absorb shocks to industry demand and credit supply

- Endogeneity of $\textit{Market share}_{ijt-2}$: results robust to using exogenous variation resulting from past bank mergers

Bank lending to distressed industries

	ln(1+Loan volume)			ln(Avg. loan size)	Any loan
Sample	All	All	All	Loan vol. $\neq 0$	All
Regression sample from 1990 to 2013					
Market share × Ind. distress	4.468***	3.136***	1.805**	-0.193	0.097**
	(1.294)	(0.934)	(0.838)	(0.213)	(0.043)
Market share	8.369***	12.654***	4.870***	-0.198	0.221***
	(1.622)	(1.271)	(0.927)	(0.374)	(0.049)
Industry distress	-0.070				
	(0.069)				
Bank-industry FE	N	N	Y	Y	Y
Bank-period FE	Y	Y	Y	Y	Y
Industry-period FE	N	Y	Y	Y	Y
N	113,494	113,470	113,470	24,292	113,470

⇒ A one-standard-deviation increase in *Market share*$_{ijt-2}$ implies a 10% increase in lending (column 3)

⇒ Results are not driven by the financial crisis

⇒ Effects are not driven by relationship banks or acquisition loans

Bank mergers as source of variation in market shares: IVE

- Bank merger in $t-2$, market share in industry i instrumented by sum of historical market shares of surviving bank j and target bank in $t-3$

	Market share	Market share × Ind. distress	ln(1+Loan volume)	Any loan
Merger-implied mkt. share × Ind. distress	0.018	0.504***		
	(0.015)	(0.080)		
Merger-implied market share	0.207***	-0.041***		
	(0.064)	(0.012)		
Mkt. share × Ind. distress (instrumented)			5.696*	0.277*
			(3.087)	(0.147)
Market share (instrumented)			-24.142**	-1.037**
			(9.384)	(0.496)
Bank-industry FE	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y
F-statistic	7.83	21.95		
N	43,849	43,849	43,849	43,849

Nature of distress

Cross-sectional tests

Are high-market-share lenders more likely to provide liquidity to industries prone to fire sales?

- Measures of asset specificity: asset redeployability using capital-flow table from the BEA (Kung and Kim 2017) and ratio of machinery and equipment to total assets in year t

Industry propensity to fire sales and bank lending to distressed industries

	ln(1+Loan volume)	Any loan	ln(1+Loan volume)	Any loan
Specificity measure	Low asset redeployability		High M&E/assets	
Sample period	$1997-2013$		$1990-2013$	
Market share × Ind. distress × Specific	5.870**	0.258**	6.564***	0.299***
	(2.296)	(0.112)	(1.589)	(0.075)
Market share × Industry distress	2.042	0.112	-0.857	-0.030
	(1.509)	(0.072)	(0.937)	(0.046)
Market share × Specific	0.433	0.003	-5.101**	-0.182
	(2.032)	(0.111)	(2.408)	(0.114)
Market share	0.058	-0.016	6.053***	0.248***
	(1.361)	(0.069)	(1.400)	(0.074)
Bank-industry FE	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y
N	80,392	80,392	106,202	106,202

Cross-sectional tests

Do high-market-share lenders provide liquidity along the supply chain to stave off externalities?

- Identify main supplier and customer industries using BEA input-output tables (1997 – 2013)

Bank lending to distressed industries' suppliers

	ln(1+Loan vol.)	ln(Avg. loan size)	Any loan	ln(1+Loan vol.)	Any loan
Sample	All	Loan vol. $\neq 0$	All	All	All
Cust. share $\times$ Cust. distress	2.994**	-0.240	0.151**	3.036**	0.153**
	(1.485)	(0.423)	(0.067)	(1.502)	(0.068)
Customer share	2.996	0.239	0.131	2.889	0.127
	(2.311)	(0.321)	(0.104)	(2.174)	(0.098)
Mkt. share $\times$ Ind. distress				2.687	0.132
				(2.264)	(0.111)
Market share				0.125	-0.017
				(2.029)	(0.106)
Bank-industry FE	Y	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y	Y
N	43,058	13,074	43,058	43,058	43,058

Bank lending to distressed industries' customers

	ln(1+Loan vol.)	ln(Avg. loan size)	Any loan	ln(1+Loan vol.)	Any loan
Sample	All	Loan vol. $\neq 0$	All	All	All
Supp. share $\times$ Supp. distress	2.314*	0.002	0.119**	1.970	0.102*
	(1.216)	(0.355)	(0.058)	(1.339)	(0.063)
Supplier share	0.073	-0.328	-0.011	-0.012	-0.014
	(2.959)	(0.249)	(0.143)	(2.834)	(0.137)
Mkt. share $\times$ Ind. distress				3.895**	0.190**
				(1.806)	(0.089)
Market share				0.052	-0.015
				(2.217)	(0.114)
Bank-industry FE	Y	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y	Y
N	38,348	11,553	38,348	38,348	38,348

Relationship industries

To which customers do banks extend new loans?

Strategic dimension of banks' decision to extend new loans to distressed industries' customers

1. Customers less levered than distressed suppliers Table
2. Highly concentrated customers to distressed suppliers Table

Mechanisms and alternative explanations

- Liquidity provision motivated by loan retention and preservation of profits (also from non-loan services) Table
- No evidence of differential yields accruing to high-market-share lenders after distress (Wilner 2000) Table
- Less diversified lenders may be better informed (Acharya, Hasan, and Saunders 2006; Loutskina and Strahan 2011)
  - No effect of banks' portfolio diversification Table

Real effects

Does higher industry-wide credit concentration alleviate consequences of distress?

1. Fewer firm exits following industry distress Table
2. Partly due to intra-industry mergers Table
3. Higher long-run abnormal returns after industry distress Table
    - $3-4\%$ higher return p.a. up to seven years after distress
    - High-market-share banks' lending decisions are efficient

Conclusion

- Banks with higher market shares are more likely to extend new loans to distressed industries
- Consistent with lenders' desire to minimize externalities
  - More pronounced in industries prone to fire sales
  - New loans to customers and suppliers, especially if relationship disruptions would be costly
- Transmission of industry shocks depends on concentration of outstanding loans
  - Concentration in the credit market may enhance financial stability (Keeley 1990)

The role of the nature of industry distress

- Results robust to using mean, rather than, median returns
- Effects not driven by idiosyncratic shocks to few large firms

	ln(1+Loan volume)			ln(Avg. loan size)	Any loan
Sample	All	All	All	Loan vol. $\neq 0$	All
Market share × Transitory shock	6.000***	4.671***	2.700**	-0.033	0.142**
	(2.056)	(1.494)	(1.137)	(0.307)	(0.057)
Market share × Permanent shock	2.748	1.228	0.508	-0.342	0.032
	(1.663)	(1.636)	(1.172)	(0.281)	(0.060)
Market share	8.365***	12.660***	4.888***	-0.200	0.222***
	(1.627)	(1.272)	(0.922)	(0.374)	(0.049)
Transitory shock	-0.019				
	(0.097)				
Permanent shock	-0.085				
	(0.081)				
Bank-industry FE	N	N	Y	Y	Y
Bank-period FE	Y	Y	Y	Y	Y
Industry-period FE	N	Y	Y	Y	Y
N	113,494	113,470	113,470	24,292	113,470

Back

Bank lending over the supply chain: relationship industries

	ln(1+Loan vol.)	Any loan	ln(1+Loan vol.)	Any loan
Cust. share × Cust. distress × Rel. industries	6.931**	0.372**		
	(2.929)	(0.164)		
Customer share × Customer distress	1.466	0.068		
	(1.848)	(0.087)		
Customer share × Relationship industries	-0.826	-0.081		
	(2.908)	(0.138)		
Customer share	3.307	0.160		
	(3.110)	(0.142)		
Supp. share × Supp. distress × Rel. industries			7.059*	0.314*
			(3.911)	(0.190)
Supplier share × Supplier distress			-0.491	-0.005
			(1.932)	(0.090)
Supplier share × Relationship industries			-2.664	-0.139
			(2.169)	(0.114)
Supplier share			0.952	0.035
			(3.210)	(0.157)
Bank-industry FE	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y
N	43,058	43,058	38,348	38,348

Back

Bank lending to distressed industries' customers: relative leverage of suppliers vs. customers

	ln(1+Loan volume)	ln(Avg. loan size)	Any loan
Sample	All	Loan volume $\neq 0$	All
Supp. share $\times$ Supp. distress $\times$ Relative leverage	3.981**	0.334	0.194**
	(1.567)	(0.372)	(0.081)
Supplier share $\times$ Supplier distress	-2.598	-0.527	-0.112
	(1.861)	(0.684)	(0.095)
Supplier share $\times$ Relative leverage	2.680**	-0.352	0.121*
	(1.185)	(0.296)	(0.062)
Supplier share	-1.546	0.169	-0.085
	(4.433)	(0.513)	(0.214)
Bank-industry FE	Y	Y	Y
Bank-period FE	Y	Y	Y
Industry-period FE	Y	Y	Y
N	36,334	10,946	36,334

Back

Bank lending to distressed industries' customers: importance of customers for their suppliers

	ln(1+Loan volume)	ln(Avg. loan size)	Any loan
Sample	All	Loan volume $\neq 0$	All
Supp. share $\times$ Supp. distress $\times$ Customer HHI	10.701*	-4.010**	0.581**
	(5.846)	(1.729)	(0.286)
Supplier share $\times$ Supplier distress	0.938	0.565	0.041
	(1.083)	(0.394)	(0.058)
Supplier share $\times$ Customer HHI	5.789	2.512*	-0.023
	(9.545)	(1.421)	(0.473)
Supplier share	-0.844	-0.681***	-0.009
	(3.258)	(0.241)	(0.159)
Bank-industry FE	Y	Y	Y
Bank-period FE	Y	Y	Y
Industry-period FE	Y	Y	Y
N	38,348	11,533	38,348

Back

Retention of loans and non-loan exposure

	ln(1+Loan volume)	Any loan	ln(1+Loan volume)	Any loan
Market share × Ind. distress × Retention	4.867**	0.235*		
	(2.341)	(0.124)		
Market share × Industry distress	0.958	0.056		
	(0.784)	(0.040)		
Market share × Retention	-2.179	-0.057		
	(1.812)	(0.098)		
Market share	5.273***	0.231***		
	(0.997)	(0.053)		
Underwriting market share × Ind. distress			1.294*	0.074*
			(0.746)	(0.041)
Underwriting market share			3.596**	0.122
			(1.493)	(0.076)
Bank-industry FE	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y
N	113,470	113,470	113,470	113,470

Back

Distressed industries' shares in banks' loan portfolios

	ln(1+Loan volume)			
Sample period	1990 – 2013	1997 – 2013	1997 – 2013	1990 – 2013
Portfolio share of industry × Industry distress	-1.229**			
	(0.468)			
Portfolio share of industry	1.611***			
	(0.377)			
Portfolio share of supplier × Supplier distress		-1.595		
		(1.248)		
Portfolio share of supplier		0.798		
		(1.006)		
Portfolio share of customer × Customer distress			0.352	
			(2.361)	
Portfolio share of customer			1.296	
			(0.920)	
Underwriting portfolio share × Industry distress				0.525
				(0.660)
Underwriting portfolio share				1.220**
				(0.549)
Bank-industry FE	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y
N	113,470	38,348	43,058	113,470

Back

Impact on cost of debt

	ln(Spread)	ln(TCB)	ln(Spread)	ln(TCB)
Horizon	After 12 months		After 24 months	
Sample	Loan volume $\neq 0$			
Market share $\times$ Industry distress	-0.053	0.119	-0.150	-0.144
	(0.126)	(0.290)	(0.127)	(0.209)
Market share	-0.022	0.382**	-0.006	0.384**
	(0.108)	(0.144)	(0.139)	(0.162)
Bank-industry FE	Y	Y	Y	Y
Bank-period FE	Y	Y	Y	Y
Industry-period FE	Y	Y	Y	Y
N	23,176	9,236	23,245	9,071

Back

Industry-wide credit concentration and firm exit

	Any bankruptcy-related delisting in industry					
Horizon	After 6 months			After 12 months		
HHI measure	All banks		Top 1	All banks		Top 1
Market HHI × Ind. distress	-0.456***	-0.384**	-0.244*	-0.392**	-0.330**	-0.252*
	(0.166)	(0.156)	(0.145)	(0.168)	(0.132)	(0.137)
Market HHI	-0.635***	-0.011	-0.059	-0.648***	-0.012	-0.046
	(0.150)	(0.084)	(0.095)	(0.149)	(0.082)	(0.093)
Industry distress	0.210***	0.142***	0.150***	0.191***	0.123***	0.141***
	(0.045)	(0.042)	(0.054)	(0.047)	(0.036)	(0.052)
Industry FE	N	Y	Y	N	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
N	2,633	2,633	2,633	2,579	2,579	2,579

Back

Industry-wide credit concentration and intra-industry mergers

	Proportion of intra-industry mergers as acquirer					
Horizon	After 6 months			After 12 months		
HHI measure	All banks		Top 1	All banks		Top 1
Market HHI × Ind. distress	0.640**	0.417*	0.293*	0.385*	0.164	0.007
	(0.244)	(0.209)	(0.149)	(0.228)	(0.227)	(0.174)
Market HHI	-0.391***	-0.187	-0.111	-0.332**	-0.115	0.005
	(0.138)	(0.180)	(0.131)	(0.154)	(0.195)	(0.139)
Industry distress	-0.113**	-0.088**	-0.104**	-0.081	-0.056	-0.033
	(0.046)	(0.039)	(0.046)	(0.053)	(0.041)	(0.050)
Industry FE	N	Y	Y	N	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
N	2,508	2,508	2,508	2,459	2,459	2,459

Back

Credit concentration and long-run abnormal returns of industries following distress

α (in % per month)	Top-quintile credit concentration	Bottom-quintile credit concentration	Long-short
Three years	-0.855***	-1.121***	0.332**
	(0.170)	(0.129)	(0.156)
N	288	287	287
Five years	-0.810***	-1.050***	0.293**
	(0.159)	(0.121)	(0.132)
N	288	287	287
Seven years	-0.771***	-0.980***	0.250**
	(0.157)	(0.116)	(0.118)
N	288	287	287

Back